CLAIMS

1. A method of operating a lithographic projection apparatus comprising:

forming at least one spot of radiation from at least a portion of a projection beam in the apparatus;

measuring, with the at least one sensor, a spatial variation in intensity of defocused radiation from the spot or from an image of the spot; and

determining properties of said apparatus from the spatial variation.

2. A method according to claim 1, wherein the at least one spot is formed at at least one of the mask plane and the substrate plane.

3. A method according to claim 1, wherein the at least one spot is formed by the beam passing through a pinhole.

4. A method according to claim 1, wherein the at least one spot comprises a small substantially transmissive region surrounded by a substantially non-transmissive region.

5. A method according to claim 1, wherein the at least one spot comprises a small substantially non-transmissive region surrounded by a substantially transmissive region.

6. A method according to claim 1, further comprising generating radiation at particular angles using, at the at least one spot, at least one radiation manipulation effect selected from the group of radiation manipulation effects comprising diffraction, scattering and diffusion of radiation.

7. A method according to claim 1, wherein the properties of the apparatus comprise at least one of:

for a pupil in the apparatus, at least one of a shape, symmetry, fine structure and centering of the angular intensity distribution of radiation with respect to an NA-diaphragm in said apparatus,

at least one of a shape and a size of an NA-diaphragm in the apparatus,

an angular dependence of radiation transmission in a projection system of the apparatus, and

an angular intensity distribution at one of a mask plane and a substrate plane, an alignment of optical components in the apparatus.

8. A method according to claim 1, further comprising scanning at least one of the spot and the sensor during the measuring.

9. A method according to claim 1, further comprising integrating the intensity measured by the sensor.

10. A method according to claim 1, further comprising adjusting the apparatus to compensate for deviation from optimal of at least one of the determined properties.

11. A lithographic projection apparatus for imaging a mask pattern in a mask onto a substrate provided with a radiation-sensitive layer, the apparatus comprising:

a radiation system, to provide a projection beam of radiation;

a first object table to hold a mask at a mask plane;

a second object table to hold a substrate at a substrate plane; and

a projection system to image irradiated portions of the mask onto target portions of the substrate;

at least one spot formation device to form at least one spot of radiation from at least a portion of said projection beam in said apparatus; and

at least one radiation sensor, to measure a spatial variation in intensity of defocused radiation from the at least one spot or an image thereof.

12. An apparatus according to claim 10, wherein said spot formation device comprises at least one pinhole located at one of the mask plane and the substrate plane.

13. An apparatus according to claim 11, wherein the at least one pinhole further comprises subsidiary dots, of size substantially equal to a wavelength of the radiation.

14. An apparatus according to claim 11, wherein the at least one pinhole further comprises a diffraction grating.

15. An apparatus according to claim 11, wherein the at least one pinhole further comprises an element to provide an angular distribution of radiation using at least one radiation manipulation effect selected from the group of radiation manipulation effects comprising diffraction, scattering and diffusion of radiation.

16. An apparatus according to claim 10, wherein, in use, the at least one sensor is defocused by a distance greater than a size of the respective spot.

17. An apparatus according to claim 15, wherein the size of the spot is approximately 1% of the image field area or less.

18. An apparatus according to claim 10, wherein the at least one sensor comprises a photodiode with small detection area.

19. An apparatus according to claim 10, wherein the at least one sensor comprises a charge-coupled device (CCD).

20. An apparatus according to claim 10, wherein the at least one sensor further comprises a lens.

21. An apparatus according to claim 10, wherein the at least one sensor is moveable so as to perform a scan of the radiation emanating from the spot.

22. An apparatus according to claim 10, further comprising a calculation unit for determining properties of the apparatus from the measurements taken by the at least one sensor.

23. An apparatus according to claim 21, further comprising actuators for adjusting said apparatus to at least partially compensate for deviation from optimal of any of the determined properties based on signals from said calculating unit.

24. A method of manufacturing a device comprising operating a lithographic projection apparatus as defined in claim 10.

25. A device manufactured according to the method of claim 23.